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Art. XI.—*The Geology of Green Gully, Keilor, with special reference to the Fossiliferous Beds.*

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(With Plates VII.-IX.)

[Read 9th July, 1925.]

Contents.

I. Introduction.

Green Gully, Keilor, is situated ten miles west-north-west of Melbourne, and is easily accessible, being about two miles from St. Albans railway station. The stream which drains the Gully is a tributary of the Saltwater River. The presence of a limestone in the locality was recognised as far back as 1893. Since then little work has been done in the area except by Messrs. Hall and Pritchard in 1897, whose account of the geology and the fossils present has been of considerable value in forming a basis for this work. This contribution is the first in which is recorded the fauna contained in the Foraminiferal limestone which, though small in extent, is of considerable interest and importance, while its position in the sequence of the rocks in the area has given rise to some discussion. I have been able to augment considerably the list of fossils, and fairly detailed examination of the microscopic contents of the limestone forms a feature of this work.

The principal references to earlier work include Graham Officer (1893), who was the first to record a limestone at Green Gully, Keilor. He described it as "yellowish and earthy," containing Polyzoa and Echinoid spines. He queried the age of the bed as Pliocene.

Messrs. Hall and Pritchard (1897) issued a list of fossils with a short account of the geology of the area.

F. Chapman (1910) did some work on the Foraminiferal limestone, and listed two species of *Lepidocyclinae,* which also occur at Batesford. Later (1914) he referred to the age of the beds as Janjukian, but possibly on a lower horizon than Batesford. This opinion was based on the presence of *Lepidocyclina verbeeki* at Green Gully.

II. Geology of the Area.

The beds in descending order are as follow:—

Recent	Alluvial deposits.
Kainozoic	Carbonaceous deposit, containing diatoms (estuarine elsewhere).
	Fresh-water limestone or Travertine.
	Newer Basalt.
	Current-bedded sands with quartzite.—Kalimnan.
	Fossiliferous Ironstone Series.—Janjukian.
	Foraminiferal Limestone.—Janjukian.
	Older Basalt.
Palaeozoic	Silurian mudstones and sandstones.

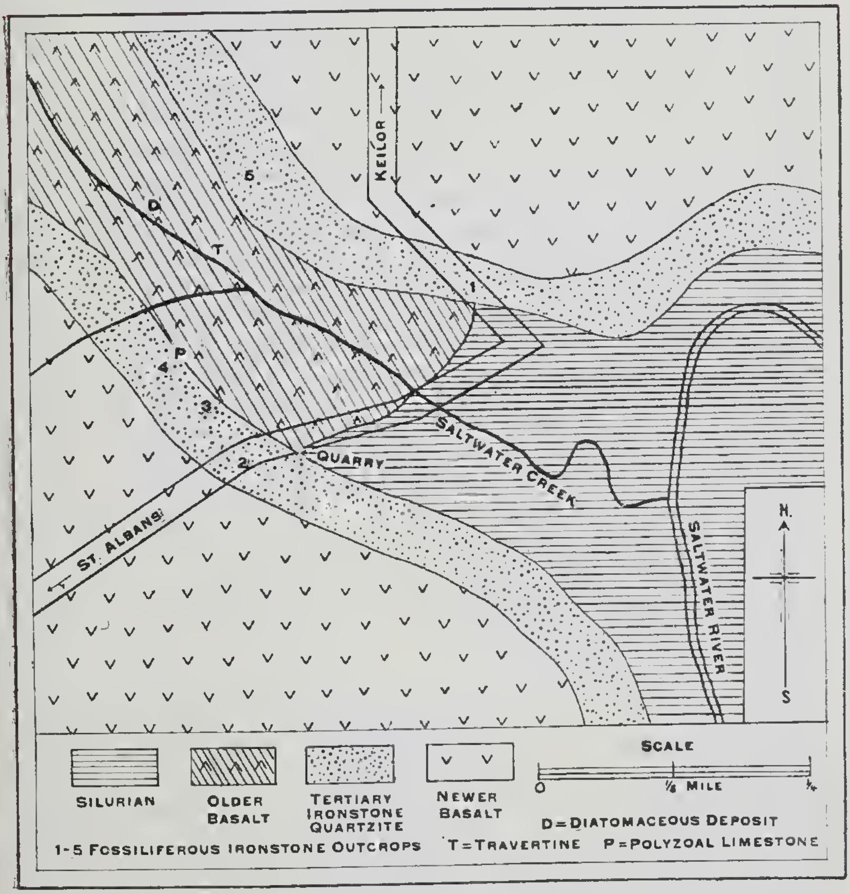

Fig. 1—Geological sketch map of Green Gully, Keilor.

The Silurian forms the bedrock of the area. There is only one small outcrop far up Green Gully, but there are larger exposures along the banks of the Saltwater (or Maribyrnong) River. Fossils such as *Monograptus aplini,* T. S. Hall, *M. priodon,* Bronn, *M. turriculatus,* Barrande, *Cyrtograptus* sp., *Retiolites australis,* McCoy, and *Trachyderma* sp., have been recorded from the neighbourhood of the monocline, 250 yards south of the Keilor Bridge.

The Older Basalt directly overlies the eroded surface of the Silurian in many places and outcrops along the Gully. It is exposed in the road cutting 150 yards north of the bridge which crosses Green Gully, where it is overlain by Janjukian fossiliferous grits, and a little further north by Kalimnan sands. At this point the Older Basalt stands out as a knoll, being exposed to the extent of 8 feet in width and 3 ft. in thickness. The rock is decomposed.

Just south-west of the bridge which crosses Green Gully is a quarry in the Older Basalt, showing practically unaltered basalt overlain by decomposed material. There is a sharp junction between the two. Here the Older Basalt is overlain by fossiliferous ironstone. Further up the Gully it is in contact with the Polyzoal limestone. The two are often separated by an intermediate bed, greyish white in colour, with brownish cavities. This bed represents a partially metasomatic replacement of the Older Basalt by calcareous matter. The structure of the Older Basalt remains in the lath-shaped crystals of felspar and partially altered olivine. Also in other parts there is an intermediate bed, represented by a reddish ferruginous band of altered limestone, traces of the original limestone being seen in the marine organisms like *Amphistegina,* Polyzoa, and *Lithothamnium.* The greater part of this rock is an aggregation of pellets connected together by calcite crystals, some of the included pellets showing concretionary structure which may be due to *Girvanella*-like organisms. (Pl. II., Fig. 11.)

Another part of the section on the south side of Green Gully shows the highest beds of the basalt flow to have a platy structure induced by weathering.

Associated with the Older Basalt in the creek bed is a reddish ochreous deposit representing a highly altered form of Older Basalt.

In the creek columnar structure in the basalt is seen together with perfect convex and concave joints, while elsewhere within the area described spheroidal weathering is characteristic.

The fossiliferous ferruginous beds on the north side and the polyzoal limestone on the south side of Green Gully immediately overlie the eroded surface of the Older Basalt. The polyzoal limestone is 120 feet in width and 5 feet thick, and indicates clear water conditions, which are favourable for the growth of Foraminifera and Corals. The bed is overlain by a narrow band of fossiliferous ironstone, but on the north side of the gully the limestone is absent. To the east the limestone passes into a finely-grained ferruginous fossiliferous ironstone bed, which in its turn passes laterally into a fossiliferous ironstone containing quartz grains. The nature of the fossils in this bed and the abundance of quartz grains present suggest a shore line deposit, while the presence of fossil wood associated with coarse grits, marks either a shoreline or beach deposit. The fossiliferous marine grits pass up into a narrow unfossiliferous bed. These can be compared with the quartz grits in the Kalimnan ironstone at Brighton, where there are concretionary bodies that appear to be infillings and replacements of coastal vegetation.

Overlying the fossiliferous and unfossiliferous grits are current-bedded sands and quartzite, the age of the deposit being probably Kalimnan from its position in the stratigraphical succession and from its lithological characteristics. It has yielded only broken fragments of freshwater shells (? *Cyclas* or *Unio*) and spicules of a fresh water sponge (*Spongilla*). On the south side of the Gully these sands are several feet in thickness, are current-bedded, and contain coarse and fine quartz grains frequently in bands, as well as layers of red ochreous and steatitic bands and nodules. These clean sands of fine quality have been quarried on a small scale in the past. In other localities along the Gully a hard white quartzite, 20 feet thick, overlies the ferruginous grits. The origin of the quartzite seems to be connected with the Newer Basalt flow, since the two are associated in other localities in a similar way.

A thickness of about 25 feet of Newer Basalt caps the quartzite and sands on both sides of the valley. The basalt is vesicular, and in the road cutting platy structure is well developed.

About 300 yards up the creek from the bridge, beyond the red ochre deposit and overlying the old creek bed, is an interesting travertine deposit. It contains boulders of quartzite, ironstone, and Newer Basalt set in a hard magnesitic matrix. Included in this travertine are some perfect little fossils, including Ostracods and numerous shells of the gasteropod, *Coxiella*. The latter genus is a brackish water form, and points to such conditions at the time of deposition. Contrasted with this are the fluviatile conditions of the present day, for in the stream which cuts through the travertine bed is the freshwater shell, *Bithinella*. This clearly shows the change from stagnant to free flowing conditions in the same area within a short geological period. The age of the bed is late Pleistocene or Holocene.

About 50 yards farther up the creek there occurs a carbonaceous deposit with a maximum thickness of 5 feet. It consists of a fine sandy material containing twigs and small pieces of wood. The finer portion consists to a large extent of diatoms, *Actinocyclus Barklyi* and *Campylodiscus echineus*, normally of marine to estuarine habit, with a few freshwater sponge spicules. The deposit frequently shows cross bedding, which can be ascribed to its having been laid down in shallow water subjected to shifting currents. The softness of the material has caused the stream to cut rapidly through it, the result being the formation of steep banks which are still being eroded. The origin of this deposit is still under consideration, since if directly laid down in estuarine swamps, it would involve a greater amount of subsequent uplift—amounting to 120 feet—than seems compatible with the physiography of the area. The age is post-Newer Basaltic.

III. The Limestone Series.

The limestone series is exposed as a lenticle about 250 yards above the bridge, on a steep slope on the south side of Green Gully. The outcrop is only 120 feet long and 5 feet thick, tapering at each end. The rock is composed almost entirely of Foraminifera, Polyzoa and Echinoid spines, whilst Sponges, Corals and fragments of Mollusca have been recorded. The upper portion is a creamy limestone with little trace of iron, contains few quartz grains, and shows imperfect stratification. In places it has been weathered, so that the Foraminifera, especially the *Lepidocyclinae,* and spines of Echinoids stand out conspicuously.

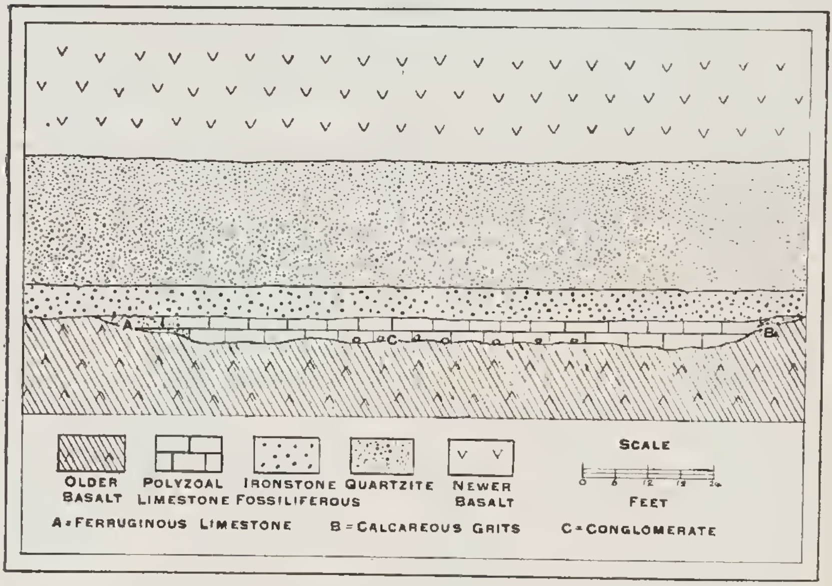

FIG. 2.—Diagrammatic section of the South Bank of Green Gully, Keilor.

This creamy limestone passes down into a darker-coloured ferruginous rock which contains abundant Foraminifera, *Lithothamnium* and quartz grains; the Foraminifera frequently showing perfect cross sections on fractured surfaces of the limestone. Quartz grains are often so numerous as to render it difficult to secure good sections for microscopical examination. This lower part is largely replaced by limonite. In its present indurated state it appears almost cherty, but microscopic examination shows no evidence of silicification.

This dark limestone passes down into a ferruginous limestone conglomerate, whose pebbles, some of which are basaltic and others of calcareous grits, are embedded in an extremely hard calcareous matrix. The nature of the pebbles suggests the conditions of the area at the time of the deposition of the conglomerate. Those of basalt point to the existence of an eroded surface of the Older Basalt, whilst the calcareous grits are the sole remains of a shoreline deposit which presumably covered part of the area. The limestone in which these pebbles are embedded is very hard and contains abundant *Lithothamnium* with numerous quartz grains.

At the northern end this limestone lenticle appears to pass conformably and rapidly up into a calcareous and ferruginous grit. Nearer the centre of the section the change into the ferruginous grits seems to be more abrupt and also a little unconformable. To the south, there is a lateral passage into a ferruginous bed, which is a replacement of the limestone. It consists of a fine-grained, ferruginous limestone with dense limonitic bands. Fossils are not abundant, and include *Antigona hormophora, Thamnastraea sera, Orbicella tasmaniensis* and *Aturia australis.*

IV. The Fossiliferous Ironstone Series.

This is exposed in five different localities on both sides of Gully. The majority of these outcrops vary as to richness of fossil contents, and also in their lithological characteristics. (See Fig. 1.)

Outcrop 1.—This is seen in the road cutting on the north side, about 150 yards above the bridge. The section is similar, but on a small scale, to that which is seen in the Royal Park cutting. Definite relations between Kalimnan sands, fossiliferous grits (Janjukian) and Older Basalt are here well illustrated. The Kalimnan sands contain a large percentage of quartz grains, and are current-bedded. To the west they directly overlie the Older Basalt, while to the centre of the section they cover chocolate-coloured fossiliferous grits, which in their turn rest on Older Basalt. To the east, the grits die out and the Kalimnan is again resting on Older Basalt.

The fossiliferous grits contain a large proportion of quartz pebbles and grains. Fossil remains are numerous, but poorly preserved, and generally in the form of casts. Only a few species are determinable; one of the most interesting being a new species of *Lithophaga* (*L. fabaeformis*). Large pebbles whose shape suggests coprolites, but which are really phosphatic segregations, occur frequently in the grits. The exposure of the fossiliferous grits measures 50 feet in length and 3 feet in thickness. The bed is lithologically distinct from the other ironstone outcrops, being much softer and containing a coarser quartz matrix, whilst perfect fossils are much rarer.

Outcrop 2.—This exposure is on the south bank, about 100 yards up the road from the bridge, and directly opposite Outcrop 1.

The exact vertical extent of this outcrop is difficult to determine, owing to overgrowth and displaced blocks of Newer Basalt and quartzite. The horizontal extent to the west is masked by blocks of Kalimnan sands which have been dislodged, while to the east it skirts the Older Basalt line of outcrop in the direction of the Saltwater River.

The ironstone is concretionary, the segregated layers being particularly noticeable in the vicinity of a fossil or some inclusion. Between these concretionary bands there is much limonitic material, showing in places a thin scaly structure. Cream and chocolate-coloured pebbles are frequently included. The external casts in this locality are very well preserved, and the hard ironstone is especially adapted for their preservation and extraction. Occasionally internal casts are found.

An interesting discovery of fossil wood was here made which throws some important light on the origin and conditions of deposition. This piece of wood came from the upper part of the bed immediately underlying the Kalimnan sands. It is embedded along with very coarse quartz grains in a fine limonitic and sandy matrix.

Outcrop 3.—This bed, which lies on the south bank of Green Gully, below the Green Gully-St. Albans road, is not very thick, and represents a highly limonitic band containing numerous fossil remains, many of which are well preserved. It passes up into unfossiliferous grits. Laterally it merges into the ferruginous limestone.

Outcrop 4.—This exposure directly overlies the Polyzoal limestone. The thickness of the bed is masked by boulders of quartzite and Newer Basalt. In only one case was a fossil recognisable, but fragments of shells were numerous. This is probably "the ferruginous grits," in which Messrs. Hall and Pritchard had been unable to find any fossils. The fossiliferous grits pass up into coarse, unfossiliferous grits.

Outcrop 5.—This outcrop is on the north side of Green Gully, about 400 yards up stream from the bridge. It is similar in all respects to Outcrop 2. The casts of fossils occur in a hard ironstone, are numerous and well preserved. The bed passes upwards into ferruginous grits of varying coarseness, while the bed beneath is covered with vegetation and hill-wash.

Origin of the Fossiliferous Ironstone Series.

The grit-like character of the ironstone suggests a deposit formed along a shallow shore line, while the fossil fauna, including abundant examples of *Patelloida* and *Haliotis* also demonstrates shallow marine conditions.

In conjunction with Mr. Chapman I have examined sections of this ironstone under the microscope, and in a piece of drift wood included in it have recognised iron-secreting bacteria. While the deposit as a whole is indubitably of shallow marine origin as demonstrated by its fossil content, it seems probable that its iron content as suggested by Gruner for American iron formation (J. W. Gruner. The origin of sedimentary iron formations: The Biwabik formation of the Mesabi Range. *Econ. Geol.*, xvii., p. 408, Sept., 1922). " may have been derived from an adjoining land area by ordinary process of weathering, carried to the sea by rivers rich in organic matter, and deposited by micro-organisms."

Messrs. Hall and Pritchard (1897), in writing of a similar ironstone at Flemington, drew attention to what seems a general factor in the formation of such ironstone beds, namely, the imperviousness of the underlying strata. In all these deposits ferruginous material is confined to a particular stratum immediately overlying an impervious bed.

V. Systematic List of Fossils.

Species recognised by the author, and already recorded by previous workers, are marked with an asterisk.*

RECENT.

(a) Diatomaceous deposit.

Plantae.

Actinocyclus Barklyi, Coates.
Campylodiscus echineus, Ehrenberg.

(b) Travertine.

Gasteropoda.

Coxiella striata, Sow. sp.

KALIMNAN.

Kalimnan sands.

Spongiae.

Spongilla sp.

Pelecypoda.

Cyclas? or Unio sp.

JANJUKIAN.

(a) Fossiliferous Ironstone.

Spongiae.

Cliona sp.

Anthozoa.

Fungia pedicella, sp. nov.
Flabellum cf. gambierense, Duncan.

Echinodermata.

Echinus (Psammechinus) woodsi, Laube, var. humilior, Bittner.
*Cidaroid plates and spines, indet.

Polyzoa.

Cellepora sp.
Adeona cf. obliqua, MacGillivray. (Sweet coll.)
Retepora sp.

Brachiopoda.

*Terebratulina suessi, Hutton sp.
*Magellania garibaldiana, Davidson sp.
*Tegulorhynchia coelata, T. Woods sp.
*Terebratella furculifera, Tate sp.

Pelecypoda.

Cucullaea corioensis, McCoy. (Sweet coll.)
Arca (Barbatia) celleporacea, Tate sp.
Arca (Barbatia) simulans, Tate sp.
Arca (Barbatia) consutilis, Tate sp.
Chlamys praecursor, Chapman sp.
Chlamys sturtiana, Tate sp.
Chlamys keiloriana, sp. nov.
*Chama lamellifera, T. Woods.
Hinnites corioensis, McCoy.
Spondylus gaederopoides, McCoy. (Sweet coll.)
*Spondylus pseudoradula, McCoy. (Sweet coll.)
Lima bassi, T. Woods.
Placunanomia ione, Gray.
Lithophaga fabaeformis, sp. nov.
Cardita alata, Tate sp.
Venericardia trigonalis, Tate sp.
Cardium septuagenarium, Tate.
Dosinia cf. johnstoni, Tate.
Callanaitis cf. allporti, T. Woods sp.
Tellina aff. porrecta, Tate.
?Corbula sp.

Gasteropoda.

Patelloida perplexa, Pilsbry sp.
Emarginula transenna, T. Woods.
Montfortula sp.
Haliotis mooraboolensis, McCoy.
*Haliotis naevosoides, McCoy.
Turbo etheridgei, T. Woods.
Turbo hamiltonensis, Harris. (Sweet coll.).
Phasianella dennanti, sp. nov.
Liotia sp.
Calliostoma serratula, Pritchard sp.
Calliostoma sp. nov. Cast, not good enough for description.
Cantharidus exiguus, T. Woods sp.
Cantharidus alternatus, T. Woods sp.
Cantharidus multicinctus, sp. nov.
Astele sp. (Sweet coll.)
Hipponyx antiquatus, Linné.
Gibbula sp.
Vermicularia funicalis, sp. nov.
Turritella septifraga, Tate. (Sweet coll.)
Bittium sp.
*Cerithium flemingtonense, McCoy.
*Potamides sp.
Eglisia triplicata, Tate.
Cypraea parallela, Tate.
Cypraea subsidua, Tate.
Trivia avellanoides, McCoy.
Cassis sp. (Sweet coll.)
Cymatium tortirostre, Tate sp.
Verconella sp.
Fusus tasmanicus, Johnston sp.
?Fasciolaria sp. (Sweet coll.)
Murex asperulus, Tate.
Fusinus cf. simulans, Tate sp.
Latirus transennus, T. Woods sp.
*Conus ralphi, T. Woods.

Pisces.

Lamna compressa, Agassiz.
Isurus retroflexus, Agassiz sp.

(b) Polyzoal Limestone.

Plantae.

Lithothamnium ramosissimum, Reuss.
Lithothamnium amphiroaeformis, Rothpletz.
Lithophyllum hydractinioides, sp. nov.

Foraminifera.

Spiroloculina cf. excavata, d'Orb.
Miliolina agglutinans, d'Orb. sp.
Haddonia torresiensis, Chapman.
Spiroplecta praelonga, Reuss sp.
Carpenteria proteiformis, Goës.
Pulvinulina scabricula, Chapman.
Pulvinulina elegans, d'Orb. sp.
Rotalia calcar, d'Orb.
Rotalia soldanii, d'Orb.
Calcarina defrancii, d'Orb.
Gypsina globulus, Reuss sp.
Gypsina howchini, Chapman.
Gypsina inhaerens, Schultze sp., var. planum, Carter.
Amphistegina lessonii, d'Orb.
Lepidocyclina tournoueri, Lemoine and Douvillé.
Lepidocyclina marginata, Michelotti sp.
Lepidocyclina martini, Schlumberger.
Lepidocyclina verbeeki, Newton and Holland.
Lepidocyclina murrayana, Jones and Chapman.

Spongiae.

Bactronella australis, Hinde.

Anthozoa.

Orbicella tasmaniensis, Duncan sp.
Thamnastraea sera, Duncan.
Mopsea tenisoni, Chapman.

Echinodermata.

Echinus (Psammechinus) woodsi, Laube, var. humilior, Bittner.
Cidaroid plates and spines, indet.

Polyzoa.

Macropora clarkei, T. Woods.

Pelecypoda.

Antigona hormophora, Tate sp.

Cephalopoda.

Aturia australis, McCoy.

Pisces.

Odontaspis sp.

VI. Descriptions of the More Important Fossils Present.

PLANTAE.

Lithothamnium ramosissimum, Reuss sp.

(Plate VII., Fig. 7.)

Nullipora ramosissimum, Reuss, 1848, Haidinger's Naturw. Abhandl., ii. (2), p. 29, pl. iii., figs. 10, 11.

L. ramosissimum, Reuss sp., Gumbel, 1871, Abhandl. K. bayer. Akad. Wiss., xi. (1), p. 34, pl. i., figs. 1*a-d*. Chapman, 1913, Proc. Roy. Soc. Vic., n.s., xxxvi. (2), p. 166, pl. xvi., figs. 1*a-c*, 2, 3. H. Yabe, 1918, Sci. Rep. Tôhoku Imp. Univ., [2] (Geol.), v. (2).

Observations.—The typical branching form of *Lithothamnium* is present, but never in such abundance as in other limestones in which it occurs, such as at Batesford. The semi-encrusting branches in some of the sections indicate an expanded modification. This form is the predominant one in these limestones.

L. ramosissimum has been already recorded from Sagara, in Japan, with the cells measuring ·025 mm. in breadth. Those in specimens from the Mallee borings are somewhat narrower in dimensions, having a breadth of ·17 mm. The Keilor form has cells measuring ·024 mm. in breadth, and ·038 mm. in length. These cell-measurements approach those of the Japanese form. There is a great deal of variation in the size of the cells, and occasionally they are minute, measuring only ·013 mm. in breadth.

L. ramosissimum is a well known component of Tertiary limestones.

LITHOTHAMNIUM AMPHIROAEFORMIS, Rothpletz.

(Plate VII., Fig. 2.)

L. amphiroaeformis, Rothpletz, 1891, Zeit. Deutschen Geol. Gesell., xliii. (2), April-June, p. 314, pl. xv., figs. 10, 14. H. Yabe, 1918, Sci. Rep. Tôhoku Imp. Univ., [2], v. (1), p. 27 (table).

Observations.—This form differs from *L. ramosissimum* in the dimensions of the cells and in the distinct concentric arrangement of the inner structure of the branch; it also has a differentiated external layer. This appropriate name was given by Rothpletz, who gives figures of the species. Some of the present examples have the inner and external elements well brought out by differential ironstaining. The original description by Rothpletz is based on a specimen from the Chalk (Turonian) of Munich.

The breadth of the cells, ·019 mm.; length, ·028 mm. Extreme dimensions—breadth, ·028 mm.; length, ·043 mm. The average dimensions approximate those of Yabe, who describes the form from the Miocene of N. Borneo.

LITHOPHYLLUM HYDRACTINIOIDES, sp. nov.

(Plate VII., Fig. 3.)

Description.—Thallus thin, encrusting, the first series of cells showing an almost spiral convolution immediately conforming itself to the surface of attachment and followed by a series of more regular habit of minute cubical cells having an approximate diameter of ·028 mm. Some of the transverse walls are incomplete, not extending across from layer to layer, but ending in a spine. This is characteristic of *Hydractinia,* but the cells are much smaller than in that genus, and there is very little doubt, from the structure of the cells, that it is referable to the above plant genus.

Observations.—This species is described from a thin slice of limestone prepared by Mr. J. M. Wilson, who has kindly presented it to the National Museum.

FORAMINIFERA.

Miliolina agglutinans d'Orbigny sp.

Quinqueloculina agglutinans, d'Orb., 1839, Foram. Cuba, p. 168, pl. ii., figs. 11-13.

Miliolina agglutinans, d'Orb. sp., Chapman, 1907, Linn. Soc. Journ. (Zool.), xxx., p. 20, pl. ii., fig. 36. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 132.

Observations.—This form is common in the Victorian Tertiaries, from the Balcombian upwards. It is the first record from Keilor.

Haddonia torresiensis, Chapman.

(Plate VII., Fig. 4.)

Haddonia torresiensis, Chapman, 1898, Linn. Soc. Journ. (Zool.), xxvi., pp. 452-56, pl. xxviii. and woodcut. Jones and Chapman, 1900, Mon. Christ. Is., Brit. Mus., p. 249. Heron-Allen and Earland, 1915, Trans. Zool. Soc. (Lond.), xx. (17), p. 616, pl. xlvi., fig. 22. Id., 1924, ibid., xxxv., p. 615, pl. xxxv., figs. 17-22.

Observations.—This specimen was found in the more compact ferruginous polyzoal limestone, and is represented by a vertical section through the test. It seems to have attached itself to the débris, and extended itself in a mound-like form. The test is of eleven slightly arched chambers. The distal chambers are very much higher and the end of the test shows the series to be more or less recurved on itself. The structure, so far preserved, is comparable with the typical *Haddonia* of tropical and subtropical seas.

It is found at the present day in the Pacific around Funafuti, whilst the original specimen described by Chapman was collected by Professor Haddon in Torres Strait. The Miocene occurrence is in the *Lepidocyclina* limestone of Christmas Island. It has been recorded from Kerimba Archipelago, off the east coast of Africa.

Spiroplecta praelonga, Reuss sp.

Textularia praelonga, Reuss, 1845. Die Verstein. böhm. Kreidef., (1), p. 39, pl. xxi., fig. 14. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 137.

Spiroplecta praelonga, Reuss sp., Chapman, 1892, Journ. Roy. Micr. Soc., p. 3, pl. xi., fig. 5.

Observations.—It is an unusually late appearance for this form, as the species is more typical of Cretaceous deposits elsewhere; as for example in the Gin Gin Chalk. Heron-Allen has lately recorded this species (as *T. praelonga*) from the Janjukian (Miocene) of Batesford. The present form was found in the sorted material.

CARPENTERIA PROTEIFORMIS, Goës.

Carpenteria balaniformis, var. *proteiformis*, Goës, 1882, Rep. Chall. Exped., p. 94, pl. vi., figs. 208-14; pl. vii., figs. 215-19.

Carpenteria proteiformis, Goës, Brady, 1884, Rep. Chall. Exped., p. 679, pl. xlvii., figs. 8-14. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 178.

Observations.—*Carpenteria* is not very abundant in the limestone sections. It shows the strongly tubulated structure of this form.

PULVINULINA ELEGANS, d'Orbigny.

Rotalia (*Turbinulina*) *elegans*, d'Orb., 1826, Ann. Sci. Nat., vii., p. 276, No. 54.

Pulvinulina elegans, d'Orb. sp., Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xi. (2), p. 288. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 180.

Observations.—*P. elegans* has been recorded from the Murray Flats (S. Aust.), and at Batesford and in the Mallee Bores (Vic.). In Bore No. 2 it is found ranging from 315-568 ft. (Janjukian) to 260 ft. (Kalimnan). This species seems to be practically confined to the Janjukian as a Tertiary fossil.

PULVINULINA SCABRICULA, Chapman.

Pulvinulina scabricula, Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 288, pl. ii., fig 2*a,b*. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 180.

Observations.—This species is typically Janjukian, being confined to the Miocene of Victoria. It is easily distinguished from related species by the distinctly convex superior surface and ornament of deep pitting. It has been recorded from Batesford and the Mallee Bores. This form was collected from the washings.

ROTALIA CALCAR, d'Orbigny sp.

Calcarina calcar, d'Orb., 1826, Ann. Soc. Sci. Nat., iii., p. 276, No. 1; Modele, No. 34.

Rotalia calcar, d'Orb. sp., Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 289, pl. iii., fig. 2. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 181.

Observations.—This very ornate species is also found commonly at Batesford (Janjukian). It has also occurred sparingly in the older series (Balcombian) at Clifton Bank, Muddy Creek.

Examples of this form were found both in the washings and in thin sections of the limestone.

CALCARINA DEFRANCII, d'Orbigny.

Calcarina defrancii, d'Orb., 1826, Ann. Sci. Nat., p. 276, No. 3, pl. xiii., figs. 5-7. Brady, 1884, Rep. Chall. Exped., ix., p. 714, pl. cvii., figs. 6*a-c*. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 182.

Observations.—Horizontal sections through test of this species show the interseptal canal system distinctly marked out by an infilling of yellow phosphatic(?) material, which may be the initial stage of glauconitization. In some cases even the tubuli are filled with this material.

Messrs. Heron-Allen and Earland point out that the figure of *Rotalia calcar* given by F. Chapman (P.R.S. Vic., n.s., xxii. (2), 1910, p. 289, pl. liii., fig. 2), is referable to *Calcarina defrancii.* As a matter of fact it is sometimes difficult to determine the relationships of the two species owing to weathering; and the distinctness of the two forms was not recognised at the time when Mr. Chapman wrote his paper. Both forms are found at Batesford, in somewhat equal abundance.

GYPSINA HOWCHINI, Chapman.

(Plate VII., Fig. 6.)

Gypsina howchini, Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 291, pl. ii., figs. 4*a,b*; pl. iii., figs. 3-5. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., June, p. 183.

Observations.—This occurrence at Keilor is especially interesting because it is the third locality in which it has been found, the previous ones being Batesford and the Mallee Bores. It is recorded from both sections and washings.

GYPSINA GLOBULUS, Reuss sp.

Ceriopora globulus, Reuss, 1847, Haidinger's Naturw. Abhandl. ii., p. 33, pl. v., fig. 7.

Gypsina globulus, Rss. sp., Chapman, 1907, Proc. Linn. Soc. N.S.W., xxxii. (4), p. 747. Id., 1910, Proc. Roy. Soc. Vic., xxii. (2), p. 290. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 183, pl. xiv., figs. 117, 118. Cushman, 1924, Samoan Foram., Carnegie Inst. pub. No. 342, p. 45.

Observations.—In some respects this form resembles the species *G. howchini,* but is smaller and perfectly spherical. It occurs at Batesford and in the Mallee Bores (Vic.), Malekula (New Hebrides), and Christmas Is. It was found in sections and washings of the limestone.

GYPSINA INHAERENS, Schultze sp., var. PLANUM, Carter.

(Plate VII., Fig. 5.)

Polytrema planum, Carter, 1876, Ann. Mag. Nat. Hist., [4], xvii., p. 211, pl. xxii., figs. 8, 9, 19.
Polytrema miniaceum, Pallas sp., var. *involva,* Chapman, 1900, Journ. Linn. Soc., xxviii., p. 17, pl. ii., fig. 3.
Gypsina inhaerens, Schultze sp., Yabe, 1918, Sci. Rep. Tôhoku Imp. Univ., [2] (Geol.), iv. (1), p. 22, pl. iv. (ii.), fig. 4; pl. v. (iii.), fig. 3.

Observations.—*G. inhaerens* is first mentioned as a Miocene fossil by Chapman in the Christmas Is. Mon., 1900. Yabe described it in *Carpenteria* limestone from British N. Borneo. This occurrence really belongs to that variable form known as *P. planum,* and although Yabe shows some hesitation on this point, Mr. Chapman says there is little doubt as to the identity. This is the first Victorian record, fossil or recent. Its association in Christmas Is. with *Lepidocyclina* is comparable with the present occurrence. It shows intergrowth with *L. ramosissimum.* The chambers are very minute and subquadrate in form.

AMPHISTEGINA LESSONII, d'Orbigny.

Amphistegina lessonii, d'Orb., 1826, Ann. Sci. Nat., vii., p. 304, No. 3, pl. xvii., figs. 1-4.
Amphistegina campbelli, Karrer, 1864, Novara Exped., Geol. Theil., i., p. 84, pl. xvi., fig. 18.
Amphistegina lessonii, d'Orb., Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 294, pl. iii., fig. 6. Cushman, 1919, Foss. Foram. from W. Indies, Carnegie Inst. Washington, publ. 291, p. 50, pl. vii., fig. 7. Yabe and Hanzawa, 1925, Sci. Rep. Tôhoku Imp. Univ., [2] (Geol.), vii. (2), p. 48, pl. vii., figs. 9, 10; pl. x., fig. 4.

Observations.—The flat forms, indicating shallow water, as well as the thick domed-shaped forms, indicating deeper water, occur at Green Gully. The species was also met with at Batesford, Papua, and New Hebrides.

LEPIDOCYCLINA TOURNOUERI, Lemoine and Douvillé.

(Plate VIII., Fig. 7.)

L. tournoueri, Lem. and Douv., 1904, Mém. Soc. Géol. France, xii. (2), p. 19, pl. i.; fig. 5; pl. ii., figs. 2-14; pl. iii., fig. 1. Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 295, pl. iv., figs. 1, 2, 6. Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., p. 186.

Observations.—This is quite a typical form of the Batesfordian phase, represented at Batesford, near Geelong, where it is excessively abundant in the lower limestone and more sparingly in the upper beds of the Filter Quarries. There the limestones pass into marls also containing a few of these forms. From the more or less total absence of this species from the material described by Heron-Allen and Earland, Mr. Chapman suggests that their samples came from one of the higher horizons at Batesford.

L. tournoueri is also recorded from the Miocene red limestone of Grange Burn, near Hamilton. The most easterly locality in Victoria is one mile N.W. of the junction of the Lighthouse and Sorrento roads at the back of Cape Schanck. It is also known from Borneo. It was found in the sorted material as well as in thin sections of the limestone.

Lepidocyclina marginata, Michelotti sp.

Orbitoides marginata, Michel., 1847, Natur. Verh. Holl. Maatsch. Wetensch., Haarlem, iii., p. 45, pl. iii, fig. 4.

Lepidocyclina marginata, Michel., Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 296, pl. iv., fig. 5; pl. v., figs. 1-3. Cushman, 1919, Foss. Foram. from W. Indies. Carnegie Inst. Washington, pub. 291, p. 60, pl. xii., figs. 1, 2.

Observations.—This form is also recorded from Batesford and the lower beds, Muddy Creek (as *Orbitoides mantelli,* Howchin, *non* Morton). It occurs at Keilor with some frequency, although complete specimens are difficult to obtain.

Lepidocyclina martini, Schlumberger.

(Plate VIII., Fig. 8.)

Orbitoides stellata, Howchin (*non* d'Archiac), 1889, Trans. Roy. Soc. S.Aust., xii., p. 17, pl. i., figs. 9-11.

Lepidocyclina martini, Schl., Chapman, 1905, Journ. Linn. Soc. N.S.W., xxx., p. 272, pl. v., fig. 2. Chapman, 1910, Proc. Roy. Soc. Vic., n.s., xxii. (2), p. 297, pl. iv., figs. 2-4.

Observations.—*L. martini* has a stellate outline, and in vertical section the pillars are more pronounced and closer together than in *L. tournoueri.*

It occurs at Batesford (Vic.) and Santo (New Hebrides). The species was recorded from both sorted material and thin sections.

Lepidocyclina verbeeki, Newton and Holland sp.

(Plate VIII., Fig. 10.)

Orbitoides papyracea, Brady (*non* Boubée), 1875, Geol. Mag., [2], ii., p. 253, pl. xiv., fig. 1.

Orbitoides (Lepidocyclina) verbeeki, Newton and Holland, 1899, Ann. Mag. Nat. Hist., [7], iii., p. 257, pl. ix., figs. 7-11; pl. x., fig. 1.

Lepidocyclina verbeeki, Chapman, 1914, Journ. Roy. Soc. N.S.W., xlviii., p. 297, pl. viii., figs. 5, 6; pl. ix., fig. 10 (var. *papuaensis*).

Observations.—Already recorded from Miocene of Sumatra, Borneo, Christmas Is., Formosa, Loo Choo Is., probably Philippines, Malekula (N.H.), Bootless Inlet (Papua). F. Chapman has also recorded it from the Balcombian of Muddy Creek, and a recent examination we have made together shows that this species is also sparingly represented at Batesford, where hitherto it was considered to be absent. (See Nat. Mus. Mem. No. 5, 1914, p. 24.)

Lepidocyclina murrayana, Jones and Chapman sp.

(Plate VIII., Fig. 9.)

Orbitoides (*Lepidocyclina*) *murrayana,* Jones and Chapman, 1900, Mon. Christ. Is. (Brit. Mus.), p. 253, pl. xxi., fig. 10.

Lepidocyclina formosa, Schl., 1902. Samml. des Geol. Reichs. Mus. Leiden, [1], vi. (3), p. 251, pl. vii., figs. 1-3.

Lepidocyclina murrayana, Chapman, 1914, Journ. Roy. Soc. N.S.W., xlviii., p. 296, pl. viii., fig. 7.

Observations.—This form is not uncommon in the sections of the limestone and resembles the Christmas Is. specimens. It occurs also at German E. Africa and Madagascar.

SPONGIAE.

Cliona cf. mammillata, Chapman.

Cliona mammillata, Chapman, 1907, Proc. Roy. Soc. Vic., n.s., xx. (2), p. 208, pl. xvii., fig. 3 (not pl. xviii. as in text).

Observations.—The present form resembles the above in the swollen sac-shaped chambers in the crypt. It is associated with a *Cerithium,* in the ironstone. The example described by F. Chapman is from Swan Reach, Gippsland Lakes, in Kalimnan strata.

ANTHOZOA.

Orbicella tasmaniensis, Duncan sp.

Heliastraea tasmaniensis, Duncan, 1876, Quart. Journ. Geol. Soc., xxxii., p. 342, pl. xxii., figs. 1-3.

Astrangia tabulosa, Tate, 1894, Journ. Roy. Soc. N.S.W., xxvii., p. 145, pl. xiii., fig. 2.

Orbicella tasmaniensis, Duncan sp., Chapman, 1919, Proc. Roy. Soc. Vic., n.s., xxxii. (2), p. 23, pl. i., fig. 1.

Observations.—This form has been recorded from Royal Park and Flinders, Victoria; Table Cape, Tasmania; and Ooldea, S. Australia.

THAMNASTRAEA SERA, Duncan.

Thamnastraea sera, Duncan, 1876, Quart. Journ. Geol. Soc., xxxii., p. 343, pl. xxii., fig. 4-6.

Observations.—This form was recorded from both limestone and fossiliferous ironstone.

FUNGIA PEDICELLA, sp. nov.

(Plate VIII., Fig. 12.)

Description of Holotype.—Cast in ironstone. Corallum of moderate size; depressed, conical, roundly elliptical. Septa numerous and distinctly perforate towards the peripheral zone. Median depression not much elongated. Base of corallum produced into a short pedicle. In the first growth-stage of about 20 mm. (longest diam.), about 80 septa in three cycles.

Dimensions.—Longest diam. (approx.) 40 mm. Shortest diam. (approx.) 32 mm. Height 15 mm.

Holotype collected by Mr. W. J. Parr and presented to Nat. Mus. Coll.

Description of Paratype.—Cast in ironstone. This specimen resembles in general characters the selected holotype, but the corallum is more depressed and the pedicle much more prominent. Moreover, the septa are slightly stronger and the perforations towards the outer zone apparently coarser. In size it agrees with the holotype, and in general with the other characters, and it may be assumed that there is a certain amount of variation which caused the differences mentioned. The paratype has been presented to the Nat. Mus. Coll. [13445]

Occurrence.—Ironstone beds, Outcrop 2, Green Gully, Keilor.

Age.—Janjukian.

Observations.—A similar form from Flemington, collected by the late Mr. J. Walker, is in Nat. Mus. Coll. Another example from Maude is in the Dennant Coll., Nat. Mus. It is represented by a cast in ferruginous limestone.

ECHINODERMATA.

ECHINUS (PSAMMECHINUS) WOODSI, Laube, var. HUMILIOR, Bittner.

Psammechinus woodsi, Laube sp., var. *humilior,* Bittner, 1892, Sitz. k.k. Akad. Wiss. Wien, ci., p. 337, pl. —, fig. 3.

Observations.—This form was found both in the ironstone in the foraminiferal limestone, the specimen from the latter being much larger. The fossil is depressed, and shows variability in the density of the secondary miliaries. It is also recorded from Royal Park and Batesford, Victoria; Murray Cliffs and Aldinga Cliffs, S. Aust.

BRACHIOPODA.

Tegulorhynchia coelata, T. Woods sp.

Rhynchonella coelata (McCoy MS.), T. Woods, 1878, Journ. Roy. Soc. N.S.W., xi., p. 77.

Rhynchonella squamosa, Tate (*non* Hutton), 1880, Trans. Roy. Soc. S. Aust., iii., p. 32, pl. ix., figs. 9*a*, *b*.

Tegulorhynchia coelata (McCoy MS.), T. Woods sp., Chapman and Crespin, 1923, Proc. Roy. Soc. Vic., n.s., xxxv. (2), p. 181, pl. xi., figs 1, 2; pl. xii., fig. 17; pl. xiii., fig. 27.

Observations.—This species has been fully described in a paper on Austral Rhynchonellacea (1922, pp. 181-3). The discovery of this form at Keilor during the present work, and the realisation that it did not coincide with the true generic definition of *Hemithyris* and *Acanthothyris* led Mr. Chapman and myself to erect the new genus *Tegulorhynchia*. *T. coelata* is fairly common in the fossiliferous ironstone, and its ornament is well preserved in the moulds. It occurs at Table Cape, Tasmania, and at several localities in Victoria and S. Australia.

Chlamys keiloriana, sp. nov.

(Plate VIII., Fig. 13.)

Description of Holotype (Cast).—Left valve of shell only is present, and is probably the more convex. Thirty-eight ribs are present, which may reach forty in complete specimen. Ribs closely scaly, squamation depressed. Furrows flattened, and smooth and of equal space to the ribs. Ears unequal in size and scaly.

Dimensions.—Greatest length of posterior region, circ. 22 mm. Height, circ. 21 mm. Depth in median area, circ. 2 mm.

Observations.—This shell belongs to the same group as *C. antiaustralis*, and seems to foreshadow the later forms of that type, including *C. asperrima*. The difference lies in the transverse squamation of the present form. In *C. antiaustralis* the ribs are flanked by narrower lateral riblets, which are scaly. The main ribs are far apart. The ribs in *C. keiloriana* are much closer together, and more numerous. The squamation is more erect in *C. antiaustralis* and *C. asperrima*. In the former there are 25 ribs, in the latter (Victorian example), 22-24, and in *C. keiloriana*, 28-40. The nearest associate appears to be a species of *Chlamys* yet to be described from Grice's Creek, in the Nat. Mus. Coll.

Occurrence.—Ironstone Beds, Green Gully, Keilor, Outcrop 2.

Age.—Janjukian.

Lithophaga fabaeformis, sp. nov.

(Plate IX., Figs. 14, 15.)

Description of Holotype (Cast).—Shell equivalved, oblong, rounded in front. Beaks near anterior end, short, prominent, close together, extending slightly beyond anterior margin. Dorsal line gently arched. Ventral border slightly undulate. Anterior extremity below the beaks well rounded. Posterior extremity squarely rounded. Growth lines distinctly marked on surface of cast. Thickness is uniform.

Dimensions.—Length ant-post., 17 mm. Approx. thickness of two valves in cast, 4·5mm. Height in anterior region, 4 mm.; in the posterior, 6·5 mm. Dimensions of paratype: length, 11·5 mm.; height, 6 mm.

Observations.—The genus is apparently new to the Tertiary fossil deposits of Australia, although one species has been already recorded under the same generic name, as *L. latecaudatus*, by Pritchard (Proc. Roy. Soc. Vic., 1901, xv., p. 88, pl. xiv., fig. 4). This form, which was found in the Janjukian of Torquay, appears to be more properly referred to the genus *Modiolus*. The well-known living form, *L. truncata*, from Auckland, is anteriorly broader than the fossil form. The beaks are inclined posteriorly rather than anteriorly, as in the fossil form.

Two fossil forms have been recorded in New Zealand, *L. striata*, Hutton, from Shakespeare Cliff, is Pliocene; *L. nelsoniana*, Suter, from Port Hills, Nelson, is Miocene. Both forms are larger than the Australian species.

Holotype presented to Nat. Mus. Coll.

Occurrence.—Ironstone beds, Outcrop 1, Green Gully, Keilor.

Age.—Janjukian.

GASTEROPODA.

Phasianella dennanti, sp. nov.

(Plate IX., Figs. 16, 17.)

Description of Holotype (in Dennant Coll., Nat. Mus.).—Shell conical, with five subventricose whorls. Smooth, with the exception of very fine lirae that are more apparent in the weathered specimens, especially on the base of the last whorl. Surface polished. Mouth ovate, the inner lip everted. In the Kalimnan holotype the colour markings are still visible, as a square-checked pattern.

Dimensions.—Height, 14 mm. Width at base, 8·25 mm. Height of aperture, inside measurement, 4·75 mm. Height of aperture, 5·75 mm.

Description of Paratype.—This occurs as a mould in the ironstone, and from the shape of the whorl and general form of the shell with characteristic suture lines, is identical with the form described from the Dennant Coll.

Observations.—In comparison with *P. australis* the whorls are not so high, but slightly more inflated, and with a tendency to become gradated. It is longer and narrower than *P. ventricosa*.

Occurrence.—Holotype, Muddy Creek (Upper Bed). Paratype, Ironstone Beds, Green Gully, Keilor, Outcrop 2.

Age.—Janjukian.

Cantharidus multicinctus, sp. nov.

(Plate IX., Fig. 18.)

Description of Holotype.—The mould of the shell elongate conical with about 6 whorls. Whorls not strongly inflated. Suture lines distinct but not deeply incised. Ornament consisting of several fine deeply cut spiral sulci on each whorl, numbering 7 on the body whorl.

Dimensions.—Height, 8 mm. Width at base, 4 mm.

Observations.—Compared with the living *Cantharidus pulcherrimus,* the present species is more elongate and has more numerous spiral bands. The suture lines are more deeply cut than in the fossil form.

Occurrence.—Ironstone Beds, Green Gully, Keilor, Outcrop 2.

Age.—Janjukian.

Gibbula sp.

This form is not precisely determinable on account of the absence of the basal portion of the shell. It is comparable with an undescribed form from Cape Otway, in the Dennant Coll.

Vermicularia funicalis, sp. nov.

(Plate IX., Figs. 19-21.)

Description of Holotype.—Gellibrand (in Dennant Coll., Nat. Mus.). Shell tubular, somewhat flattened and irregularly coiled. Surface very faintly ornamented with concentric lirae, giving the shell a slightly corrugated appearance. In the method of coiling there is a tendency to form an irregularly convex shape on one side and concave on the other.

Dimensions.—Diam. of close spiral, 20 mm. Width of aperture, 2 mm.

Description of Paratype.—Curlewis (coll. F. Chapman, pres. Nat. Mus.). The tube is narrower than in the holotype, coiled but more depressed and slightly concave on one side. The surface shows characteristic wrinkling where the shell is preserved, though most of the specimen is in form of a cast.

Dimensions.—Diam. of close spiral, 18 mm. Width of aperture, 1 mm.

Description of Paratype.—Keilor (pres. to Nat. Mus. coll.). Tubular shell about same thickness as in holotype; depressed, with whorls much more numerous than in either the type or the Curlewis paratype. The shell is represented mainly by a cast, though portions of the shell-surface are seen on the hollow mould, and this shows the typical wrinkling of the Gellibrand holotype.

Dimensions.—General width of flat spiral, 25 mm. Width of aperture, 2 mm.

Observations.—Amongst the six species already described by Tate from the Australian Tertiaries, there is none which seems to approach the present species, which is easily distinguished by its comparatively slender tube and flattened and closely coiled shell.

The recent species *V. flava,* Verco, (Pl. IX., Fig. 22) shows, in some examples, that the basal portion has the same tendency as the fossil to form a conoidal type of shell, but it rapidly uncoils into an isolated tube. A figure is given which emphasises this character in specimens obtained from Bass Strait (cable between Flinders and Tasmania). These specimens were kindly lent by Mr. C. J. Gabriel.

Occurrence.—Holotype, Gellibrand; also another specimen from Cape Otway in Dennant Coll. Paratypes, Curlewis, in yellow limestone, Chapman Coll.; and Green Gully, Keilor, in polyzoal limestone.

Age.—Janjukian.

CEPHALOPODA.

Aturia australis, McCoy.

A. zic-zac, Sow. sp., var. *australis,* McCoy, 1876, Prod. Pal. Vic., dec. iii., p. 21, pl. xxiv., figs. 1-5.

A. australis, McCoy, Chapman, 1921, Proc. Roy. Soc. Vic., n.s., xxxiv., p. 12.

Observations.—Among the Janjukian localities for this species are Spring Creek, Torquay, Vic., and Table Cape, Tas. The present form is of medium dimensions.

PISCES.

Lamna compressa, Agassiz.

Lamna compressa, Agassiz, 1843, Poiss. Foss., iii., p. 290, pl. xxxvii., figs. 35-42. Chapman and Cudmore, 1924, Proc. Roy. Soc. Vic., n.s., xxxvi. (2), p. 127.

Observations.—One specimen of this comparatively rare species from Keilor, kindly lent for examination from the Cudmore Collection, has since been presented to the Nat. Mus. Coll.

Isurus retroflexus, Agassiz sp.

(Plate IX., Fig. 23.)

Oxyrhina retroflexus, Agassiz, 1843, Pois. Foss., iii., p. 281, pl. xxxiii., fig. 10.

Isurus retroflexus, Ag. sp., Chapman and Cudmore, 1924, Proc. Roy. Soc. Vic., n.s., xxxvi. (2), p. 130, pl. x., fig. 31.

Observations.—This species is represented in the ironstone series by a well-preserved specimen still attached to the matrix, and although the basal part of the tooth has decayed the outline still shows the characteristic form seen in the above species. Plesiotype pres. Nat. Mus. Coll. Outcrop 2, Green Gully, Keilor.

VIII.—Summary of results.

1.—It is probable that the Older Basalt is a terrestrial flow. At the summit of the flow the junction between the limestone and the basalt is marked by a broken surface of the latter mingled with a dense limestone deposit and quartz grains.

2.—The polyzoal limestone is a single local lenticle found in the one locality on the south bank of Green Gully upstream from the bridge. The basal portion of the limestone series overlying the Older Basalt is more ferruginous and harder than the succeeding yellow limestone, whilst the latter seems to be free from the gritty particles found in the basal portion. The great abundance of *Lithothamnium* in these lower indurated beds points to the existence of shallow water reefs, whilst the rarity or even absence in the yellow limestone above indicates a deepening of the sea in the area.

3.—The upper portion of the limestone series is comparable with the Batesfordian phase in its general faunal aspects, and which F. Chapman regards as Burdigalian in its foraminiferal facies. *Lepidocyclina verbecki* occurs here with some frequency, and a re-examination of the Batesford limestone shows it to be also represented there.

4.—Where a junction of the limestone and the overlying ironstone is seen, there is sometimes a replacement of the original limestone by ferruginous material, which makes the line of boundary impossible to define.

5.—There is a faunal difference between the limestone and the ironstone faunas, as is seen by the rarity of species in common, the only persistent forms being *Thamnastraea sera* and *Echinus* (*Psammechinus*) *woodsi*, var. *humilior*.

6.—The discovery in the probably Kalimnan sands of spicules of *Spongilla* and broken fragments of *Cyclas?* or *Unio*, suggests a freshwater origin for this deposit.

7.—It seems probable that the Travertine is older than the Diatomaceous deposit, although the evidence is not conclusive.

8.—An interesting feature of the ironstone fauna of the area is the occurrence of certain species which hitherto have been restricted to Table Cape. They comprise the following:—*Thamnastraea sera, Cardium septuagenarium, Turbo etheridgei, Cantharidus alternatus, Fusus tasmanicus.* There are also several others which are not entirely restricted, but are characteristic of the Table Cape fauna.

9.—Seven new species are herein described:—*Lithophyllum hydractinioides, Fungia pedicella, Chlamys keiloriana, Lithophaga fabaeformis, Phasianella dennanti, Cantharidus multicinctus, Vermicularia funicalis.* Of the 22 species enumerated by Hall and Pritchard from Keilor, 10 are common to this list. Of the 19 species recorded by Dennant and Kitson from Keilor, 10 are found in the present list. The total number of species recorded in this paper, excluding indeterminate forms, is 103.

ACKNOWLEDGMENTS.

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EXPLANATION OF PLATES.

(Numbers in brackets refer to registered specimens in the National Museum.)

Plate VII.

Fig. 1.—*Lithothamnium ramosissimum*, Reuss. Typical branch fractured in the matrix. Polyzoal limestone, Keilor. ×16.

Fig. 2.—*Lithothamnium amphiroaeformis*, Rothpletz. Ferruginous limestone, Keilor. ×16.

Fig. 3.—*Lithophyllum hydractinioides*, sp. nov. Holotype. Initial growth of thallus. Polyzoal limestone, Keilor. ×184. [13456]

Fig. 4.—*Haddonia torresiensis*, Chapman. Vertical section through complete test. Polyzoal limestone, Keilor. ×16.

Fig. 5.—*Gypsina inhaerens*, Schultze sp., var. *planum*, Carter. Vertical section. Polyzoal limestone, Keilor. ×16.

Fig. 6.—*Gypsina howchini*, Chapman sp. Median section. Polyzoal limestone, Keilor. ×28.

PLATE VIII.

Fig. 7.—*Lepidocyclina tournoueri*, Lem. and Douv. Section in polyzoal limestone matrix, Keilor. ×16.

Fig. 8.—*Lepidocyclina martini*, Schl. Vertical section, Polyzoal limestone, Keilor. ×16.

Fig. 9.—*Lepidocyclina murrayana*, Jones and Chapman. Vertical section. Polyzoal limestone, Keilor. ×16.

Fig. 10.—*Lepidocyclina verbeeki*, Newton and Holland. Vertical section, excentric. Polyzoal limestone, Keilor. ×16.

Fig. 11.—Base of ferruginous limestone, Keilor. ×16. Arrows point to *Amphisteginae*.

Fig. 12.—*Fungia pedicella*, sp. nov. Holotype. Ironstone beds, Keilor. Janjukian. Nat. size. [13444]

Fig. 13.—*Chlamys keiloriana*, sp. nov. Ironstone beds, Keilor. Janjukian. ×2. [13446]

PLATE IX.

Fig. 14.—*Lithophaga fabaeformis*, sp. nov. Holotype. Ironstone beds, Keilor. Janjukian. ×2. [13447]

Fig. 15.—*Lithophaga fabaeformis*, sp. nov. Paratype. A shorter form. Ironstone beds, Keilor. Janjukian. ×2. [13448]

Fig. 16.—*Phasianella dennanti*, sp. nov. Holotype. Dennant Coll. Upper beds, Muddy Creek. Kalimnan. ×2. [13450]

Fig. 17.—*Phasianella dennanti*, sp. nov. Paratype. Wax squeeze of a mould. Ironstone beds, Keilor. Janjukian. ×2. [13451]

Fig. 18.—*Cantharidus multicinctus*, sp. nov. Holotype. Ironstone beds, Keilor. Janjukian. ×2. [13449]

Fig. 19.—*Vermicularia funicalis*, sp. nov. Paratype. Polyzoal limestone, Keilor. Janjukian. Nat. size. [13453]

Fig. 20.—*Vermicularia funicalis*, sp. nov. Holotype. Gellibrand. Dennant Coll. Janjukian. Nat. size. [13452]

Fig. 21.—*Vermicularia funicalis*, sp. nov. Paratype. Curlewis. Janjukian. Nat. size. [13454]

Fig. 22.—*Vermicularia flava*, Verco. Recent. Bass Strait. Nat. size.

Fig. 23.—*Isurus retroflexus*, Ag. sp. Ironstone beds, Keilor. Janjukian. Nat. size. [13455]